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BENGAL DISTRICT GAZETTEERS.

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MĀNBHUM.

[*Price—In India, Rs. 3; in England, 4s 6d.*]

BENGAL DISTRICT GAZETTEERS.

MĀNBHUM.

BY

H. COUPLAND,

INDIAN CIVIL SERVICE.

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PREFACE.

THE account of Mānbhum district contained in this volume has been compiled from the Statistical Account of Bengal, volume XVII, by Sir W. W. Hunter, and from materials gathered from local records. In the sections dealing with history and ethnology frequent reference has been made to Colonel E. T. Dalton's Descriptive Ethnology of Bengal and various articles by the same author in the Journals of the Asiatic Society, to Mr. J. D. Beglar's Report of a Tour through the Bengal Provinces in 1872-73, published in the Archæological Survey of India Reports, and also to the various reports and letters (unpublished) of Sir H. H. Risley (Superintendent of Ghātwāli Survey, 1880-1884), Sir E N. Baker (Deputy Commissioner), Colonel Dalton, Messrs. Hewett, Forbes and Gait (at various times Commissioners of the Chota Nagpur Division) on the subject of the ghātwāls of the district.

For the Chapter on Geology I am indebted to Mr. E. W. Vredenburg of the Geological Survey of India; for the article on economical products and also for much assistance and advice elsewhere in the volume, to the Revd. A. Campbell, D.D, of Pokhuria. I desire also to acknowledge gratefully the assistance received from Rai Nanda Gopal Banerji Bahadur in obtaining materials for and revising various articles in regard to which his detailed knowledge of the district extending over 33 years was invaluable, and to express my thanks to Mr. J. H. Lindsay, I.C.S., Subdivisional Officer of Dhanbaid, for revising the Chapter on the Coal-fields of Mānbhum.

H. COUPLAND.

The 24th December 1910.

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GAZETTEER

OF THE

MANBHUM DISTRICT.

CHAPTER I.

PHYSICAL ASPECTS.

GENERAL DESCRIPTION.

THE district of Mānbhum forms the eastern part of the Chota Nāgpur Division and lies between 22° 43′ and 24° 4′ North Latitude, and 85° 49′ and 86° 54′ East Longitude. It contains an area of 4,147 square miles and a population, according to the census of 1901, of 1,301,364 souls. The principal town and administrative head-quarters is Purūlia situated some three miles north of the Kāsai River in 23° 20′ N. and 86° 22′ E.

Origin of name.

The district takes its name from one of its most easterly Parganas, at the chief place in which, Mānbazār or Mānbhum Khas, was the head-quarters of the Jungle Mahals district from 1833 to 1838, in the earlier of which years the Mānbhum district was constituted. Of the origin of the name it is difficult to speak with any certainty; the apparently obvious derivation from *mān* (Bengali) "the land of honour" may, at once, be rejected as the Bengali connection with the Pargana and district can hardly date back much more than two centuries. Dr. Hunter prefers "the land of the wrestlers" (*malla* or *mala*). Other authorities, including Mr. W. B. Oldham and Sir H. H. Risley, follow General Cunningham and ascribe the origin of the name to the Dravidian tribe of Māl referred to by Pliny as Mālli and identical apparently with the Sauri, the Saurian family to which the Rājmahāl Pahārias, the Orāons and the Sabārs belong, and neighbours of the Mandei or Monodes, identified with the Munda Kols. The tribal name Māl, Māle, or Maler is variously derived from a Druvidian root meaning a hill, (c. f. Pahāria, the hillmen), and from *male* "a man," the tribe speaking of themselves as "men" just as the Kolarian tribes, Sonthals, Mundas and Larka Kols (Hor, ho) do at the present day. That the district name is derived from non-Aryan sources is the more probable as a very large number of the village names and several of the pargana names (*e.g.*, Pâtkum) undoubtedly come from one or other of the aboriginal dialects, though some of them have within recent times adopted a more Aryan appearance.

Boundaries. The district is bounded on the north by the districts of Hazâribagh and the Sonthal Parganas; on the east by Burdwan, Bânkura, and Midnapore; on the south by Singhbhum, and on the west by Rânchi and Hazāribagh. The whole of the northern boundary is marked by the Barākhar river; on the north-east the Barakhar and Dāmodar separate the district from Burdwan, and on the west and south the Subarnarekha river flows along the boundary for short distances.

Configuration. In shape Manbhum is an irregular parallelogram, having a length of 90 miles from north to south and a breadth of 60 miles from west to east, with Purulia, its administrative head-quarters, situated a little south of the centre. The Damodar river divides the district into two unequal portions, the northern portion corresponding to the Dhânbâid, until recently the Gobindpur, subdivision with an area of 803 square miles, and the southern to the Sadâr subdivision of 3,344 square miles

Natural divisions and scenery. The district has been described as the first step of a gradual descent from the table land of Chota Nagpur to the delta of Lower Bengal; more properly it is the last step in the descent from the great elevated high lands of Central India, the Chota Nâgpur plateau with its general elevation of 2,000 to 2,500 feet forming the intermediate stage. The general characteristics are those of an upland district, consisting, as it does, in great measure, of metamorphic rocks, spurs projected from the tableland on the west, and swelling ridges of laterite. Towards the east, as the metamorphic rocks thin out, the laterite ridges thicken, the undulations so characteristic of Chota Nâgpur are less pronounced, and the dips between the ridges are broader and more level; the country is more open, and presents the appearance of a series of rolling downs, dotted here and there with isolated conical hills. This description applies generally to the north and east of the district, including the valleys of the Dâmodar and Kâsai rivers, with their various affluents. In the north-western corner, however, a double spur of hills branches out from the range of which Parasnâth is the most striking feature and, extending across Pargana Tundi, forms the watershed between the Dâmodar and Barâkhar rivers. In the adjoining Pargana of Nāwagarh, to the west, the lower slopes of the Parasnāth range extend well into the district, and outlying ridges and isolated hills, locally known as *dungris*, extend in more or less parallel lines along the Jamunia river to the banks of the Dāmodar.

South of this again spurs from the Hazāribagh part of the Chota Nāgpur plateau abut on or extend short distances into the western parts of Parganas Khaspel and Jainagar. In the adjoining Pargana of Jhalda, there begins a series of isolated groups of hills and isolated peaks, some of them of considerable elevation, which still further south form a regular range known as the Bāghmundi or Ajodhya range, which in places reaches an elevation of over 2,000 feet and forms the water-shed between the Subarnarekha and Kasai rivers. This range which, indeed, is rather a plateau of considerable extent, on which there are a number of flourishing villages, than a mere range of hills, ends somewhat abruptly in Pargana Mātha, but numerous isolated peaks and groups of low hills connect it with the spurs from the Rānchi plateau on the west, and the range separating Pargana Patkum from the Kharsāwan State in the south-west Practically continuous with the last, save for the very narrow valley of the Subarnarekha, is another range extending along the Singhbhum boundary known by the name of its highest peak, Dalma. This, like the Baghmundi range, marks the division between the watersheds of the Subarnarekha and the various feeders of the Kāsai, of which the Nengsai, the Kumari and the Tatko are the most prominent. Of picturesque scenery the more level portions furnish but little in the dry months of the year except where the Parasnath or Tundi ranges in the north, the Bāghmundi range in the centre and west, and Dalma in the south give a striking background to the picture. The general absence of trees in this part of the country, and the fact that cultivation is almost entirely confined to the rice crop, gives in the dry season the general appearance of a barren waste. In the rains the prospect is more pleasing when the fresh green of the young rice shades off into the darker greens of the grass which springs up everywhere when the first showers fall, and contrasts with the browns of the ripening crops on the high lands, and of the bare gravel ridges, varied here and there by black masses of exposed rock. These effects are naturally enchanced when the hills give a background of mingled jungle growth and enormous masses of rock of quaint shapes and varying shades of colour. In the early hot weather the jungle-covered areas, whether on the hills or in the plain, present for a time a brilliant spectacle, the red blossom of the *palâs* (Butea frondosa) contrasting in striking fashion with the fresh green of the new leaves. Generally it may be said of the district that, from the point of view of the picturesque, the seasons of the new leaves and the *palâs* blossom, that is to say the early hot weather, and of the young rice, August-September, are the two most favourable; of the constantly picturesque and of the grand there is little or none in comparison with the more favoured high lands to the west.

The general trend of the hill system has been described in the previous paragraph, and it remains only to notice the more prominent peaks. Of these Parasnâth, though not actually within the district, forms unquestionably the most conspicuous feature of the landscape throughout the northern and western parts of the district. Compared with its commanding height (4,480 feet) and generally striking appearance all other hills in this neighbourhood are dwarfed; on clear days in the rains and early cold weather it is a prominent object even so far south as Purūlia, a distance of some 70 miles; its southern and eastern lower slopes are within the district and it is the great hill (the Marang Buru) of the Sonthals who constitute nearly one-sixth of the whole population, and consequently it may be claimed as to some extent appertaining to, though not within, the district. Highest within the district itself is the crowning peak of the Dalma range (3,407 feet), but it is in no sense the rival of Parasnâth; it wants the bold precipices and commanding peaks of that hill, and its height loses effect from the fact that it is merely the highest point in a long rolling ridge reached by a gradual rise from the lower hills on either side. The slopes of the hill are still covered with dense jungle, though much of the big timber has been cut away within recent years; its summit is accessible to men and beasts of burden. Sawai (2,637 feet) and Chârâjural (2,412 feet) in the extreme south-western corner of the district are even less conspicuous in proportion to their height than Dalma, shut off as they are by a group of hills on the Mânbhum side of which Auli (2,108 feet), Karânti (1,932 feet), Châtam (1,766 feet) with others ranging from 1,100 to 1,300 to the north and east are sufficiently high to take from the effect. Ganga Buru (or Gaj Buru) the highest peak in the Bâghmundi range makes much more of its 2,220 feet, but the chief features of this range are several more or less detached lower peaks of which one at the north-east corner, in shape like an irregular church steeple or a gigantic tooth, is a very conspicuous object for miles around. At the northern end of the same range but detached from it, not far from Jhalda, Bānsa (1,789 feet) attracts some attention rising up abruptly nearly 1,000 feet from the general level of the plain in the shape of huge sugarloaf. Pānchkot or Pānchet (1,600 feet) is the most conspicuous object in the north-east of the district, in Pargana Chaurāsi, some 35 miles north of Purūlia. In shape it is a long crescent like ridge rising to its highest point at its eastern extremity; it is covered with small but dense jungle, with some fine clumps of mango and mahua scattered over the low foot hills at its base. At the foot of its eastern face are the ruins of the old palace and fort of the Pānchet Rājas, and above and also below them, of some ancient temples, an account of which will be given in a later chapter. A few miles south of Pānchet is a picturesque group of rocky hills of bold irregular formation with great masses of grey black boulder jutting out above the scanty scrub jungle which clothes the lower slopes. One more precipitous than the rest with a clear drop of several hundred feet from an immense boulder on the top is known as Execution Hill, the story being that from this spot the Rāja of Pānchet used, in ancient days, to have his enemies as well as detected evil-doers hurled over the face of the cliff to be dashed to pieces on the rough stones at the foot. In the extreme north of the district the only peak of any prominence, apart from Parasnāth, is the curious double-peaked hill in the Tundi range, known as Dumunda; its height is inconsiderable, but its appearance makes it a conspicuous object.

RIVERS.

Following the natural slope of the district all the rivers which intersect or take their rise within it, have an easterly or south-easterly course. They have the usual characteristics of hill-fed streams; their beds are entirely or almost dry during the greater part of the cold season, and the whole of the hot season; they are not navigable during any portion of the year, with the single and intermittent exception of the Dāmodar, and are subject to sudden and violent freshets which are usually of very short duration. Except where they run over exposed rock, their beds are usually deep in gravel and sand; their banks are abrupt and broken into deep cuts wherever the drainage from the surrounding country finds its way to the level of the stream. Cases of alluvion are very rare, and the only notable instance is the small island thrown up at the junction of the Dāmodar and Barākhar rivers. Diluvion on a small scale is on the other hand constant; huge masses of gravelly soil are constantly being undermined and detached from the banks, and every heavy fall of rain scours out the small cuts and channels which feed the larger streams. There is no regular system of river-cultivation, and as a general rule the banks are covered with low scrub jungle.

Barākhar. The northernmost river in Mânbhum is the Barākhar, which skirts Parganas Tundi and Pândra and forms the northern and north-eastern boundary of the district. Running at first in a south-easterly direction, it suddenly sweeps round the low group of hills to which Durgâpur (1,186 feet) gives its name, and runs due south with several bends and turns till it joins the Dāmodar a few miles south of Chirkunda and Barākhar, at the trijunction of Parganas Domurkonda, Chaurāsi, and Shergarh. Just above this point it receives from the west its only important tributary, the Khudia, which takes its rise in the extreme west of the district between the Parasnāth and Tundi ranges, and drains the whole country between that range and the high ridge which marks the nothern limit of the Jharia coal-field.

Dâmodar. The Damodar, as already stated, divides the Dhânbāid from the Sadar Division; its course through the district is almost due east. On its entry into the district it receives from the north the waters of the Jamunia, a considerable stream which marks the boundary between the Hazāribagh and Mānbhum districts along almost the whole length of Pargana Nâwagarh. Of its other affluents from the north the Katri, which takes its rise in the foot hills below Parasnāth and cuts through the coal-field area, is the most important From the south its main affluent is the Gowai which before its junction with the Damodar just east of Bhojudih itself receives the waters of the Ijri and the Harâi which drain practically the whole country east of the Jhalda hills, north of the Rānchi Road and north and west of the Purūlia-Asansol Railway line as far up as the Pānchet hill. The watershed between this and the Kāsai river is somewhat inconspicuously marked by a line of high ridges, occasionally rising to sufficient height to be designated hills, running across the district in an easterly and later northerly direction as far as the Pānchet hill.

The Dâmodar receives the waters of the Barākhar on the Burdwan border, and here, as well as near the confluence with the Gowai, a small island is formed in a loop of the stream. Navigation of the Dâmodar even in the rainy season is difficult owing to the sudden changes in depth due to freshets, and the violence of the current which tends to throw up sand banks in constantly shifting sites. Rafts of timber still come down from the jungle areas higher up, but since the opening of the Railway the conveyance of coal in country boats by this route has practically ceased.

Dhalkisor and Silai.

South of the Dāmodar and between it and the Kāsai, the Dhalkisor and the Silai, which become important streams lower down, drain a large portion of Pargana Ludhurka in which they take their rise. Within the district they are short streams of no particular importance; their watershed is marked off from that of the affluents of the Dāmodar by the high ridge of which the isolated peaks at Raghunathpur are the only prominent feature. Between the two and between them and the Kāsai the watershed is even less distinctly marked by the Magura hill just south of Hura.

Kasai.

The Kāsai is the most important river of the centre portion of the district. It takes its rise on the extreme west in the hills north of Jhalda and, flowing in a south-easterly direction, leaves Purūlia a few miles on the north and finally passes out into the Bānkura district at a point some 60 miles from its source, and after draining practically the whole of the centre and south-eastern portion of the district east of the Bāghmundi and north of the Dalma range. Just outside the district beyond Manbazar it receives the waters of the Kumari which, with its affluents the Tatko and the Nengsai, drains the whole of the northern slope of the Dalma range. Within the district it is quite impossible for navigation; it is particularly liable to sudden and violent freshets and in the year 1898 it overflowed its banks, which are generally of very considerable height, and near Purūlia, where in the dry weather it is a stream at most a foot deep and 15 or 20 feet in width, it presented a breadth of over 2,700 feet. Villages situated on the high banks were washed away and crops destroyed by this flood, which is still remembered as the great flood of 1301 (Bengali year).

Subarnarekha.

West of the Bāghmundi range and south of Dalma the only river of importance is the Subarnarekha For 35 miles it follows a tortuous course along the district border from Bhojpura, some 10 miles north-west of Jhalda, to Jojodih on the borders of Pātkum and Bāghmundi Parganas where it turns towards the east, its general direction previously having been due south, and intersects the former Pargaṇa till it meets the district border a few miles south of Chandil. It then flows for some miles along the Singhbhum-Mānbhum border in an easterly direction, skirting the Dalma range, and finally leaves the District near Kapāli. Its only affluent of any size or importance within the district is the Karkari, which rises in the Rānchi District and bisects the Pātkum Pargana for some 20 miles, meeting the Subarnarekha a few miles east of Ichāgarh.

Lakes and Marshes. There are no large marshes in the district, nor are there any natural lakes. Artificial lakes of considerable size have, however, been formed in several places by running dams across small ravines or valleys, so that the enclosed space is filled by the natural drainage from above. Of such, the most noticeable example is the Sāhib-bāndh at Purūlia the water in which, when full in the rains, covers over 50 acres, and even at the lowest some 30 or 35 acres. The dam or *bāndh* was constructed about 1848 mainly by convict labour, and according to local tradition the then Deputy Commissioner refused to consider any petition filed unless the petitioner had first done a day's hard labour on the *bāndh*. There are avenues of trees on three sides, and a couple of wooded islands which greatly add to the general picturesqueness. From a utilitarian point of view the lake is the chief source of drinking water for the western half of the town, and it is under contemplation at present to construct another *bāndh* or tank below it for bathing and the washing of clothes, and reserve the Sāhib-bāndh entirely for drinking purposes. At Gobindpur there is a similar bāndh on a smaller scale known as the Risley Bandh; others constructed by private enterprise are the Rāni-Bāndhs at Pāndra and Jaypur; the Sābir-Bāndh at Babudih, the Jobūna-Bāndh near Rangāmati, and the large railway *bāndh* recently made by the Bengal-Nāgpur Railway Company near Adra to provide the railway settlement with pure drinking water. The construction of similar *bāndhs* forms the main part of the district programme of village famine works, their economic value as reservoirs of drinking water being at any rate equalled by their value for irrigation purposes, the fields lying immediately at the foot of the dams being kept constantly moist by percolation of the water, and forming ideal rice-growing land. Canals and artificial water courses are practically unknown.

Geology. The geological formations are the Archæan and the Gondwāna. The Archæan rocks consist of gneiss and crystalline schists, the gneiss occupying by far the largest portion of the district. It belongs principally to the group known as Bengal gneiss, which is remarkable for its varied composition, consisting of successive bands of intermixed granitic, granulitic and dioritic gneisses, and micaceous chloritic and hornblendic schists, with a laminated or foliated structure striking usually east and west. About the centre of the district is a great belt of unfoliated or only slightly foliated granitic intrusions, also striking east and west, and extending westwards into the adjacent district of Rānchi. Crystalline limestones occasionally occur. Along the southern boundary there exists a group of rocks resembling the

Dharwār schists of Southern India, which were originally sedimentary and volcanic, but have been altered into quartzites, quartzitic sandstones, slates of various kinds, hornblendic mica, and talcose and chloritic schists, the latter passing into potstones, green stones and epidiorites.

Quite close to the southern boundary of Mānbhum, the schists are invaded by a gigantic dyke of basic igneous rock forming an imposing east and west range, which culminates in the lofty Dalma hill. The schists are here more metamorphosed than elsewhere with a considerable development of iron ores; in this neighbourhood, moreover, the rocks are richest in gold.

The Gondwānas, whose age as determined by fossil plants, is partly upper palaeozoic and partly mesozoic, are the principal rocks from an economic point of view. They occur along the Dāmodar river and form the Rānīganj coal-field, the western portion of which lies in Mānbhum, and the rich Jharia coal-field almost entirely situated within the district. The Gondwāna rocks comprise the Māhādeva, Pānchet, Rānīganj, ironstone shales, Barākhar and Tālcher divisions, of which all but the first belong to the lower Gondwānas. The series consists throughout almost exclusively of shales and sandstones. The coal seams are restricted to the Barākhar and Rānīganj divisions.

The coal-fields owe their preservation from denudation and their present situation to a system of faults that has sunk them amidst the surrounding gneiss. The faults are easily recognized along their boundaries, especially on the south, and sulphurous hot springs are often situated in their neighbourhood. Innumerable fissures are occupied by intrusive dykes of basalt and of mica-apatite-peridotite, the latter being frequently detrimental to the coal seams which have often been burnt away by it. These intrusions are of the same age as the volcanic rocks of the Rājmahāl hills.*

Minerals.

The most important mineral found in Mānbhum is coal, of which a more detailed account will be found in a later Chapter. The whole of the Jharia field, 180 square miles in extent, lies within the district, besides portions of the Rānīganj-Barākhar field. On its western border, the Jharia field practically joins on to the Bokāru-Rāmgarh field which is now being exploited in Hazāribagh.

Iron is plentiful in several parts of the district, and the Barākhar iron and steel works have in the past obtained much of their ore from Malti and Cheliāma in Barābhum and Pātkum in the south and from various places within the limits of the Rānīganj coal-field in the north-east of the district There a clay iron-stone, which constitutes a large proportion of the iron-stone shales, is especially rich and plentiful, and is sometimes associated with carbonaceous matter forming a black-band iron ore Magnetic and titaniferous iron ores are also found among the gneissose and schistose rocks; red hematite occurs in the siliceous fault breccias of the same 'areas, and lateritic iron ores also exist Iron is worked on a small scale, principally by the aboriginal tribes, in various places among which may be mentioned Ajodhya on the Baghmundi plateau, and Akro and other villages in the south of Pargana Mānbhum. The rocks on the southern boundary of the district constitute part of the northern edge of the auriferous tract of Chota Nagpur. They are traversed by innumerable gold-bearing quartz veins, from which has been derived the alluvial gold obtained in all the rivers that drain the schist area. The Pātkum prospecting syndicate attempted to work the gold on an extensive scale but failed, and the careful investigation to which the area has been subjected of late years leaves very little hope of extracting the gold at a profit. An attempt has also been made to work gold at Akro in the south of Mānbhum Pargana but so far the result has not been very successful. Washing for gold goes on at a number of places along the Subarnarekha river in Pargana Pātkum; the results are, however, very small, the average earnings of a washer being not more than four or five annas a day.

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* A fuller account of the geology of this district which has been specially written by Mr. E. Vredenburg of the Geological Survey of India for this volume is printed as an Appendix to this Chapter.

Lead ores (principally argentiferous) are found near Dhādka in south-eastern Barābhum, the amount of silver per ton of lead in two samples tested being 119 and 99 ounces. Copper ores are found at Purda 30 miles south, and at Kaliānpur 32 miles due west from Purūlia. Traces of corundum have been found in the Tinsāya Ghātwāli tenure in Barābhum, where also various superior clays including kaolin are also said to exist in workable quantities. Chalk, red ochre and traces of mica are found here and there, but the only attempt to work the last named commercially (in Pāndra in the north of the district) failed. Soap-stone quarries are worked at several places in the south of the district, particularly round about Pātkum, and the stone produced is fairly extensively employed for the manufacture of idols, plates, bowls and the like. The process of manufacture is simple, the blocks being roughly dressed by hand and then cut into form in a rude lathe, and finished off with a smooth surface. Kankar suitable for the manufacture of lime is found in most parts of the district, and rubble, quartz, sand-stone, trap and basalt are quarried for building purposes, road metal and ballast.

BOTANY. Trees and vegetation.

It is only in respect of a comparatively limited area, namely, along the hill ranges to the north-west, south and south-west of the district, that Mānbhum can now be described as a well wooded country, and even in these parts denudation has gone on to such an extent that the amount of large timber left, except in the most inaccessible places, is very small. There are small areas of protected forest in the Mātha and Kailapāl estates which, in course of time (they have only been under protection since 1892), should develop into fairly useful forests, and here and there zamindars and others have made special efforts to preserve some small patches usually as a shooting preserve (shikar jungal or mahal). In ghātwāli villages some sort of protection is nominally enforced, but the strict application of rules in the case of villages nearer the centres of civilization or in the midst of a fairly thick population has, in practice, been impossible and only a small percentage of the ghātwali jungles is now, in consequence, worthy of the name of forest Of the four sections, therefore, into which Mr. V. Ball* in 1869 divided the district, the first, *i.e.*, "original jungle land in which trees are of large size" has almost entirely disappeared. The second "stunted jungle land from which timber is regularly cut, and where the trees are never allowed to attain respectable dimensions" describes accurately the bulk of the jungle that survives The third and fourth classes, "dry, gravelly and rocky ground cut up by ravines, incapable of supporting a tree cultivation", and "land under cultivation" have proportionately increased; the former, owing to the practice of "jhuming" or bringing under cultivation jungle areas not suited for permanent cultivation, and which are necessarily denuded of soil once cultivation, or the attempt at cultivation, ceases, has probably increased at least as rapidly, if not more rapidly than the actual permanently cultivated area. Mr. Ball gives as among the most characteristic trees in his first division the *Sāl* (*Shorea robusta*), *Asan* (*Terminalia tomentosa*), *Kusum* (*Schleirhera trijuga*), *Kend* (*Melanoxylon*) and *Piar* (*Buchanania latifolia*). On the higher hills the bamboo as a rule takes the place of other trees. Herbaceous plants are comparatively scarce, but there are numerous large scandent creepers among which the *Butea superba* with its magnificent orange-red flowers, and the *Bauhinia Vahlii* are the most conspicuous; parasites and epipytes are represented by several species of loranthus and of orchids. Mr. Ball's second and third divisions have no very characteristic vegetation; stunted *sāl*, the result of cutting the original too high from the ground, the *palās* (*Butea frondosa*) and various grasses and more or less dwarfed bushes of different species form the ordinary vegetation; timber trees of any size are ordinarily conspicuous by their absence, though in the areas nearer the hills the general appearance of open forest or park like country is preserved by the presence of numerous *mahua* (*Bassia latifolia*). These, as well as *palās* besides the various fig trees, the mango, *nim*, *bair* or plum tree, *jamun* and jack with very occasional date palms, are the principal varieties found in and near the cultivated tracts.

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* Flora of Manbhum—J. A. S., 1869.

Economic uses.

Of trees and plants yielding good timber, or of which various parts and products serve useful economic purposes, Dr. A. Campbell, of Pokhuria, gives the following account of the most important; he mentions at the outset that the list is not exhaustive, and that, apart from the trees and shrubs referred to, there are over 90 species of plants which minister to the necessities of the people by providing food of a sort during scarcity or famine.

Dilleniaceæ.—Two species of the genus Dillenia, are fairly common. Dillenia indica, Linn, (Chalta, Beng., Korkot, Sant.) and D. pantagyna, Roxb., (Sahar, Sant.). The former yields a good timber and fruit of the latter is eaten. *Anonaceæ.*—Miliusa velutina, Horsk. fil and Thoms, (Kāre, Beng., Ome, Sant.) is a middle sized tree, the timber of which is used for yokes and axles and the fruit is edible. Anona squamosa, Linn., (Sārpha, Beng., Mandargom, Sant.,) the custard apple, and A. reticulata, Linn., (Mandal, Beng., Gom, Sant.,) the Bullock's heart, are found cultivated and in a semi-wild state. Both yield edible fruit.

Capparidaceæ.—Caparis horrida, Linn., (Buru asaria, Sant.,) a scrambling shrub is met with. *Bixineæ.*—Cochlospermum gossypium, D.C., (Golgol, Beng., Hopo, Sant.,) is remarkable for its large, handsome yellow flowers, which appear before the leaves. It yields a gum, known commercially as Hog-gum, and from the seeds a soft silk cotton is obtained which is known by its trade name of *Kopok* fibre. Flacourtia Ramontchi, L'Herit., (Obir, Beng., Merleo, Sant.,) yields an edible fruit. *Dipterocarpaceæ.*—Shorea robusta, Gaertn., (Sāl, Sakhua, Beng., Sarjom, Sant.,) is a large gregarious tree yielding a heavy, strong, tough timber, which is valuable for all purposes where a smooth polished surface is not required. There seem to be two forms of this tree, the most prevalent having a dark-brown heart-wood, while that of the other is white slightly tinged with red. The fruit is eaten, the resin is used locally for several purposes but does not appear to be exported, the bark serves as a tan. This is the sacred tree of the Sonthals, the tribal deities being worshipped under its shade. —*Malvaceæ.* Is important for the number of fibre-yielding plants embraced in it. Bombax malabaricum, D.C., the cotton tree (Shimal, Beng., Edel, Sant.,) attains to a very large size. The wood is white and soft, and as broad planks can be had from it, it is in much request for doors. The seeds yield a fine silky cotton, which is in demand for stuffing, and large quantities are exported under the trade name of *Kopok* fibre. Kydia calycina, Roxb., is a large shrub or small tree from the bark of which a serviceable fibre is procured. Other wild *Malvaceæ* which yield fibre are mostly small shrubs, many of which, such as Thespasia Lampas, Dals. et Gibbs.; Abutilon indicum, Don.; Urena repanda, Roxb.; U. sinuāta, Linn.; U. lobata, Linn.; Sida mysurensis, Wight; S. carpinifolia Linn; S. rhombifolia, Linn., yield fibre deserving attention. *Sterculiacæ* embraces many trees, and shrubs among which the following are worthy of note:—Sterculia urens, Roxb. (Telhor, Beng., Telheo, Sant.), S. villosa, Roxb., (Udal, Beng. Ganjher, Sant.), and S. colorata, Roxb., are middle sized deciduous trees, all of which yield a very strong bast fibre. Helicteres Isora, Linn. (Maronphol, Beng., Petchamra, Sant.,) is a large shrub with a spirally twisted fruit, which is given medicinally in colic, etc. The bark yields a bast fibre. Pterospermum acerifolium, Willd. (Makchan, Beng., Machkunda, Sant.) is a tall ever-green tree, not very common, the large white flowers of which are used as a disinfectant. *Tiliaceæ.*—Grewia hirsuta, Vahl. (Kukurbicha, Beng., Seta andir, Sant.), G. tiliæfolia, Vahl. (Jang olat Sant.), G. sapida, Roxb., var. Campbellii, Watt.; G. vestita, Wall., (Kœlata, Beng., Olat, Sant.), G. scabrophylla, Roxb., (Tarse kotap, Sant.), G. lævigata, Wall., are all shrubs or small trees. The timber of these which attain to the size of trees is remarkably strong, tough and light, and is used for purposes where these qualities are in request. All yield a strong bast fibre. *Rutaceæ.*—Ægle marmelos, Correa., (Bel, Beng., Sinjo, Sant.) is found wild and is also planted largely for its fruit, which possesses a high medicinal value. Feronia Elephantum, Correa (Katbel, Beng., Koohbel, Sant.) is not common, but probably indigenous. *Burseraceæ.*—Boswellia serrata, Roxb. (Salga, Beng., Sant.) yields an aromatic gum. Garuga pinnata, Roxb., (Kanwer, Sant.); Bursera serrata, Colebr. (Armu, Sant.), all three species are deciduous and the timber is of little value. *Meliaceæ* Azadirachta indica, A. Juss., Syn. Melia Azadirachta, Linn (Nim, Beng., Sant,) a large evergreen tree naturalized all over the district. The seeds yield a medicinal oil. Melia Azadarach, Linn., (Bakain, Beng, Bokom, Sant.) the Persian Lilac. A middle-sized tree, not indigenous. Soymida febrifuga, Adr Juss. (Rohan, Beng., Ruhen, Sant.), is a large tree with tall, straight trunk, heart-wood dark reddish-brown, and very durable. Cedrela Toona, Roxb., (Tun, Beng., Sant) yields a very fair timber for finer carpentry. *Olacineæ.*—Two species may be mentioned :—Olax scandens, Roxb., a small bush or climber; and O nana, Wall., a medium-sized shrub. *Celastrineæ.*—Celastrus paniculatus, (Willd Kujri, Beng, Sant.), the seeds of which yield a medicinal oil; Elæodendron Roxburghii, W and A (Raj jehul, Beng, Neuri, Sant.) *Rhamneæ.*—Ventilago madraspatana, Gaertn., Syn. Ventilago calyculata, Tulasne (Raerui-Beng., Bonga Sarjom, Sant.) is a large climber, the seeds of which yield an oil in taste approaching *ghee*, used for culinary purposes. The bark yields a bast fibre. There are four species of Zizyphus: Zizyphus Jujuba, Lam. (Kul, bair, Beng, Jom, janum, dedhaori janum, Sant.). There are two forms of this, one cultivated, which grows to be a good sized tree, the fruit of which is very palatable, the other, the wild form, is a small gregarious bush, the fruit of which, though sour, is largely eaten Zizyphus xylopyra, Willd. (Korkot, Beng, Karkat Sant.); Z. oxyphylla, Edgew., (Seakul Beng., Kurit rama Sant.); Z. rugosa, Lam. (Sahra, Beng., Sahra, Sant); all yield edible fruits.

Ampelideæ—Is represented by several genera, mostly climbing plants, with a few shrubs, none of which is of any economic value. *Sapindaceæ.*—Schleichera trijuga, Willd. (Kusum, Beng., Baru, Sant.), the only species of any importance in the district, is a large tree valued mainly for the oil yielded by its seeds and for the superior quality of lac procured from it.

Anacardiaceæ.—Odina Wodier, Roxb. (Kasmala, Beng., Doka, Sant.) is a large deciduous tree, the wood of which is said to be suitable for making bobbins. Spondias mangifera, Willd. (Amra, Beng. Sant.) the Hog-plum, is a large deciduous tree, fruit edible. Buchanania latifolia, Roxb. (Pial, piar, Beng. Tarop, Sant.) is a middle sized tree, the fruit and gum of which are eaten. Mangifera indica, Linn. (Am, Beng, Ul, Sant.) the mango tree; a large evergreen tree, apparently indigenous, but largely planted as groves near villages and on road sides The fruit of the cultivated tree is highly esteemed, but that of the wild is sour and stringy. Semecarpus Anacardium, Linn. f., var. cuneifolia (Bhelwa, Beng., Soso, Sant.) the marking nut tree. The drupe is about one inch in length, the pericarp is full of an acrid juice, which takes the place of marking ink, the hypocarp when ripe is of a bright orange colour and is edible. *Moringeæ.*—Moringa pterygosperma, Gaertn. (Sogna sag, Beng, Munga arak, Sant.) the Horse raddish tree. This small tree does not seem to be indigenous, but is largely cultivated, leaves, flowers and fruit eaten

Leguminosæ—Is represented by a large number of genera and species comprising many large timber trees, but the majority are shrubs or climbers. There are five species of Crotalaria; two of Indigofera; seven of Desmodium; one of Ouginia, O. Dalbergioides, Benth.; one of Abrus, A. precatorius, Linn.; one of Mucuna; one of Erythrina, E. indica, Lam.; one of Pueraria; one of Spatholobus, S Roxburghii, Benth., a large climber yielding a strong bast fibre; two of Butea, B. frondosa, Roxb., (Palas, Beng., Murup, Sant.), a fairly large tree, gregarious in its habits, noted for its brilliant orange, red flowers, and as a large producer of lac. B. superba, Roxb, a large climber with flowers of a flaring orange colour, larger than those of B frondosa; three species of Flemingia, all small shrubs; three of Dalbergia, D. lanceolaria, Linn. (Siris, Beng., Chapot Siris, Sant.), D. latifolia, Roxb (Sotsal, Beng, Satsayar, Sant), both large deciduous trees yielding good timber; D. volubilis, Roxb., a large scrambling shrub; one of Pterocarpus, P. marsupium Roxb. (Murga, Beng., Murga Sant.) a large deciduous tree with a brownish heart-wood; one of Pongamia, P. glabra, Vent (Kurunj, Beng., Sant.) probably introduced into the district, but has been long naturalized, seeds yield a useful oil and fruits edible; one species of Tamarindus, T. indica, Linn (Tetul, Beng., Jojo, Sant.) yielding an edible fruit; of Cassia five, C. Fistula, Linn. (Bandarlœ, Beng., Nuruic, Sant.), flowers in large pendulous racemes of a bright yellow, known as the Indian Laburnam; of Bauhinia seven, B. malabarica, Roxb., B purpurea Linn., B. variegata, Linn., B. retusa, Ham., B acuminata, Linn., B. racemosa. Lam., B. vahlii, Wight et Arn., the first six species are medium sized trees, the last is a gigantic climber (Chikor, Beng., Lamak lar, Jom lar, Sant), yielding an excellent bast fibre and an edible bean; one of Adenanthera, A pavonia, Linn., not indigenous; of Mimosa, one, M. rubicaulis, Lam.; of Acacia, five, A. Farnesiana, Willd., A. pennata, Willd., A. cæsia, Willd., A. Catechu, Willd., A arabica, Willd.; Of Albizzia four, A. myriophylla, Bl., A. odoratissima, Benth., A. Lebbek, Benth.,

A. procera, Benth. (commonly known in the ver. as Siris), all large trees yielding excellent timber; *Combretaceæ.*—The most important are Terminalia belerica, Roxb. (Behra, Beng., Lopong Sant.); T. Chebula, Retz. (Harla, Beng., Rol. Sant.) yields the myrabolams of commerce; T. tomentosa, W. et Arn. (Asan, Beng., Atnak, Sant.), Tasar silkworm is largely reared on this species; T. Arjuna, Bedd. (Arjun, Beng., Kauha, Sant.) all four species are large trees and are very common. *Myrtaceæ.*—The principal are Eugenia operculata, Roxb., E. Jambolana, Lam. (Jamun, Beng., So kod, Sant.), E. caryophyllifolia, Lmk., all yield edible fruits; Barringtonia acutangula, Gærtn., (Kumia Beng., Hinjor, Sant.); Carea arborea, Roxb. (Kumbhir, Beng., Kumbir, Sant.). *Lythraceæ*—The most important species are Lagerstrœmia parviflora, Roxb. (Sidha, Beng., Sekrec, Sant.), a large gregarious tree, which coppices well, the gum is edible. Lawsonia alba, Lam. (Mihendi, Beng., Sant.), a shrub never found in a wild state, makes a good hedge, the leaves yield the "henna" dye which is used to colour the skin and hair. Woodfordia floribunda, Salisb. (Dhatki, Beng., Ichak, Sant.) a small bush, which is extensively used in house-building, being placed above the rafters to support the thatch. The flowers yield a dye and, before the aniline dyes were introduced, were exported in large quantities to Patna and Cawnpore. *Samydaceæ.*—Casearia tomentosa, Roxb. (Chorcho, Beng., Sant.), a small tree, the fruit is employed to poison fish. *Cornaceæ.*—Alangium Lamarckii, Thws. (Akura, Beng., Dhela, Sant.), a small deciduous tree, with a hard, close and even-grained heartwood. *Rubiaceæ*—Embraces about 18 genera, of which the following are the most important:—Anthocephalus Cadamba, Miq. (Kadam, Beng., Sant.), a large deciduous tree of rapid growth, the fruit is eaten and the flowers offered in worship. Adina cordifolia, Hook. f. and Benth., (Karam, Beng., Sant.), a large deciduous tree, a branch of which is fixed by the Hindus in the courtyard of the house during the observance of the *Karam* festival. Sonthals also dance round a branch of it at their *Karam* festival. Stephegyne parvifolia, Korth, syn. Nauclea parvifolia, Willd. (Gulikodom, Beng., Gore, Sant.), a large deciduous tree, the bark of which yields a good bast fibre. Hymenodictyon excelsum, Wall. (Bhorkond, Beng., Sant.), a large deciduous tree, the inner bark of which is in repute as a febrifuge. Wendlandia tinctoria, D. C. and W. exserta, D.C., are small bushes, fairly common, but without any economic value. Gardenia latifolia, Ait. (Pepra, Beng., Popro, Sant.), a small deciduous tree whose fruit is edible. There are two species of Randia. R. dumetorum, Lamk., and R. uliginosa, D.C., both small trees which yield edible fruits. Canthium didymum, Roxb. (Garbagoja, Beng., Garbhagoja, Sant.), is a small or medium-sized tree with no particular economic use. Pavetta indica, Linn., and P. indica, Linn., var. tomentosa, Roxb., are small bushes. Ixora parviflora, Vahl., is a common, but, from an economic point of view, an unimportant tree. Morinda tinctoria, Roxb., syn. M. exserta, Roxb. (Chaili, Beng., Sant.) is a moderate sized deciduous tree seldom, if ever found in a purely wild state. This at one time was a most important tree as the bark of the root was extensively used to dye yellow and red. There are five species of Oldenlandia, all small unimportant shrubs with the exception of O. corymbosa, Linn., which is the Madras red dye known as chey root in commerce. There are several other plants belonging to this order, but they serve no economic uses and are not therefore noted. *Compositæ.*—A large number of plants found in the district belong to this order, but as all are herbs or shrubs with little economic value they are passed over. *Myrsineæ.*—Embelia robusta, Roxb., is a large shrub or small tree, with wood of a reddish hue.

Sapotaceæ.—Bassia latifolia, Roxb. (Mahua, Mahul, Beng., Matkom, Sant.) is a very large deciduous tree with reddish-brown, very hard heartwood. The timber is used for many purposes, but it is not lightly cut down. The flowers are an important article of food. When dry they store well, keeping in good condition for a very long time. The trees in most villages are divided among the ryots in proportion to the area they cultivate, but landless labourers generally are in possession of one or more trees. When the owner does not collect the produce himself, he as a rule engages another to do so, allowing him sometimes a third and sometimes a half thereof in return for his labour in collecting. *Mahua* is cooked and eaten by preference along with rice or rice water. Eaten alone it is said not to digest readily. A coarse spirit distilled from *Mahua* is the liquor most generally consumed in the district. The fruit (Kochra, Beng., Kuindi, Sant.) when unripe is eaten as a vegetable cooked. When ripe the pulp is only eaten. It is generally infested by a small white worm and can only be consumed by the less fastidious. The kernel of the fruit yields an oil which is used for culinary purposes, for lamps and anointing the person. To extract the oil the kernels are split and dried in the sun. They are then pounded into coarse flour in the *dhenki*, put into an airtight basket and steamed. The material is then wrapped up tightly and carefully with *saboe* grass and placed in the press which is worked with a lever. The oil as it readily solidifies is often used to adulterate *ghee*.

Ebenaceæ.—Three or four species of Diospyros are found within the district, the most important being Diospyros tomentosa, Roxb., which some botanists include in Diospyros Melanoxylon, Roxb. (Kend, Beng., Terel, Sant.), a small or medium sized tree never entirely leafless. The heartwood is very dark coloured, resembling ebony in hardness, and is considered to be of great value. The fruit when fully ripe is very palatable. *Styraceæ* — Symplocos racemosa, Roxb. (Lodh, Beng., Lodam, Sant.), is a small tree, the leaves and bark of which are used in dyeing. *Oleaceæ.*—Nyctanthes arbortristis, Linn. (Sitik, Beng., Saparom, Sant.), is a large shrub or small tree, generally gregarious in dry situations. It is sometimes cultivated on account of the fragrance of its flowers which open in the evening and drop off at sunrise. Jasminum arborescens, Roxb., is a scandent shrub frequenting the vicinity of streams. *Apocinaceæ.*—Carissa Carandas, Linn., Alstonia scholaris, R. Br., Holarrhena antidysenterica, Wall., Wrightia tomentosa, R. and S., Nerium odorum, Soland., Thevetia Neriifolia, Jus., are probably the most important species. *Asclepiadeæ.*—Calotropis gigantea, R. Br. (Akand, Beng., Akaona, Sant.), a common gregarious bush, in flower all the year round. Its inner bark gives a fibre of fine silky texture, which is very strong and is used for bow strings, etc. The seeds are surrounded by silky hair which is used for stuffing pillows, the root is used to dye with. Calotropis procera, R. Br., fibre, silk from the seeds, and root are used in the same way as those of C. gigantea. Dregea volubilis, Benth., is a twining shrub, which yields an extremely strong fibre, from which Brāhmans make the *poita* or sacred thread. *Boragineæ.*—Cordia Myxa Linn.) Buch, Beng., Buch, Sant.), and C. Macleodii, H. F. and T. (Jugia, Sant.), are medium sized trees, the wood is valued for the purpose of making cattle yokes. Ehretia lævis, Roxb. (Pusi pan, Sant.), is a middle sized tree, of no particular economic use. *Convolvulaceæ.*—Ipomæa is represented by seven species. Erycibe paniculata, Roxb., is the only species which attains to any size, the others are herbs. *Solanaceæ* —Datura fastuosa, Linn. (Dhatura, Beng., Sant.) is common, growing on waste places. Solanum xanthocarpum, Schrad. et Wendl., is a common procumbent thorny plant. *Scrophularineæ.*—There are two species of Torenia, one of Vandellia, two of Ilysanthes, one of Sopubia, one of Bonnaya, three of Limnophylla, one of Dopatrium, etc. *Bignonaceæ.*—Oroxylum indicum, Benth. (Sonae, Beng., Bana hatak, Sant.), a small tree remarkable for its long, flat, sword-like capsule and large flowers. The bark and fruit are used in tanning and dyeing. Stereospermum suaveolens, D. C. (Padal, Beng., Pader, Sant.) is a large deciduous tree, the wood of which is durable and easy to work. The tree is not common. *Acanthaceæ.*—Contains mostly herbs, among which the following are represented:—Barleria, Dædalacanthus, Strobilanthes, Ruellia, Peristrophe, Hemigraphis. Hygrophila, Rungia, Andrographis, etc., etc. *Verbenaceæ.*—Vitex Negundo, Linn. (Sindwari, Beng., Sinduari, Sant.), is a large shrub or small tree. V. pidunculairs, Wall., Syn. Vitex alata, Roxb. (Bhado, Beng., Bhadu, Marak, Sant.), is a middle sized tree, with a hard, close grained timber. Gomelina arborea, Linn. (Gamhar, Beng., Kasmar, Sant.) is a large quick growing deciduous tree, with a close and even-grained wood, which is used largely in making the finer parts of palanquins. Two species of Callicarpa, two of Premna, and five of Clerodendron are found within our area. *Labiatæ.*—There are several plants belonging to this genus found in the district, but all are herbaceous. Three species of Leucas afford food in times of famine. *Amarantaceæ.*—Represented only by herbs, but these are important from an economic point of view as they afford sustenance to the poor in times of scarcity. The following may be noted in this connection:—Celocia argentata, Moq., Ærua lanata Linn., Amarantus gangeticus, Linn., Digera arvensis, Forsk., and Acternanthera sessilis, R. Br. *Polygonaceæ.*—With the exception of Polygonum glabrum, Willd., the leaves of which are used as a pot-herb, this contains no species of any importance.

Urticaceæ.—This contains many valuable species, but there is space only for the following:—Artocarpus integrifolia, Linn. (Kathal, Beng., Kanthar, Sant.), the jack tree is a large evergreen tree planted extensively for its fruit which is highly valued. The wood which is durable and takes a fine polish is largely employed for all kinds of carpentry. A. Lakoocha, Roxb., (Dahua, Beng., Dahu, Sant.), is a large tree, the male flower buds and fruit are eaten. Ficus bengalensis, Linn. (Bor, Beng., Bare, Sant.), the banyan, is a large evergreen tree, which throws down aerial roots from the branches, the fruit is eaten, and the wood which is of little value is mainly used to make solid cart wheels. F. infectoria, Willd. (Pakare, Beng., Sant.), F. religiosa, Linn., (Pipar, pipal, Beng., Hesak, Sant.), F. cordifolia, Roxb., (Sunum jor, Sant.), F. Cunia, Buch. (Bhoka dumbar, Beng., Horpodo, Sant.), F. glomerata, Roxb. (Dumbor, Beng., Loa, Sant.), F. tomentosa, Willd. (Chapakia bare, Sant.), F. scandens, Roxb. yield edible fruits. *Euphorbiaceæ.*—The more important species are Phyllanthus Emblica, Linn. (Aura, Beng., Meral, Sant.), P. multilocularis Mull. Arg. Putranjiva Roxburghii, Wall., Briodelia retusa, Spreng. (Kadrupala, Beng., Karke, Sant.), Croton oblongifolius, Roxb. (Putol, Beng., Gote, Sant), and Mallotus philippinensis, Mull. Arg (Rohra, Beng., Rora Sant.). This latter is a gregarious shrub or small tree and yields the *kamela* dye of commerce *Palmæ.*—Borassus flabelliformis, Linn. (Tal, Beng, Tale, Sant.), the palmyra palm, and Phœnix sylvestris, Roxb., (Khajur, Beng, Khijur Sant.), the wild date palm, are the only species indigenous to the district. The palmyra palm seems to flourish everywhere, but the wild date palm does not grow so readily in all situations.

Gramineæ.—Of these the first to be noted is Dendrocalamus strictus, Nees. (Bans, Beng., Mat. Sant.), the male bamboo. This is apparently the only bamboo indigenous to Manbhum. Bambusa Tulda, Roxb., (Ropa bans, Beng., ropa mat, Sant.), the bamboo of Bengal, clumps of this bamboo are becoming increasingly frequent in the vicinity of villages. It grows readily when transplanted and is a source of considerable profit to the villagers. Of fodder grasses the best known is Cynodon Dactylon, Pers. (Dub, Beng, Dhobighas Sant.), Pollinia eriopoda, Hance (Baboe, saboe, Beng, Bachkom, Sant.). The supply of this grass from wild sources being limited owing to the decrease of jungle it is now being largely cultivated. It is used for all kinds of rough twine and cordage and is of very great importance. Cattle eat it when young. A species of Aristida (Bhalki, Beng., kharang, Sant.), supplies the material from which house brooms are made. Heteropogon contortus, R. & S. (Khar, Kher, Beng. Sauri, Sant), (is the principal thatching grass of the district. It grows to a height of two feet or over and lasts longer than rice straw. Andropogon muricatus, Retz. (Bena, Beng., Sirom, Sant.) is common, found in moist situations. The fragrant roots known under the name of *khaskhas* are used in the manufacture of *tatties.* The brush (Konch) with which a weaver applies starch to the warp of a web is made from the roots of this grass Besides these there are many others in the plains and hills comprising species of Andropogon, Setaria, Pennisetum, Panicum, Paspalum, Eragrostis, Oplismenus, Perotis, Spondiopogon, Chrysopogon, Pollinia, Eleusine, Apluda, Sporobolus, Agrostis, Chloris, Aristida, Pogonatherum, Elytrophorus, Leersia, Ischæmum, Heteropogon, Isachne, Arundinella and others.

Though the physical features of the district resemble so closely those of the adjoining districts of Chota Nāgpur, and though it shared till comparatively recent times their reputation as a happy hunting ground, this reputation is no longer deserved, and, speaking generally, the district is now singularly destitute of wild animals and game of all descriptions The causes are not far to seek; cultivation and the clearing of jungles for this purpose has widely extended during the last 20 years, and denudation of the jungles, even where the land is not required or suitable for cultivation, almost as if not more, rapidly. Moreover, the Sonthal population has rapidly increased, and, as is well known, their hunting habits very quickly denude the country in their immediate neighbourhood of all small and ground game, both fur and feathered, deer, pig and hare, and birds, both game and non-game, and in the absence of their natural food the larger carnivorous animals must necessarily die out or remove to more favoured parts. It is possible now to travel through and to beat miles of jungle covered hill and see not a single head of game of any description; country eminently fitted for the smaller varieties of deer, for wild pig, for hare, for partridge, the jungle fowl or the pea fowl is untenanted save by the squirrel and the owl, and the natural habitation of the tiger, the leopard and the bear may, perchance, produce a stray hyæna or jackal. The larger game that are still occasionally seen or shot are the exception. Wild elephants have within recent years been seen in the jungles on the Dalma range in the south, visitors no doubt from Dhalbhum, where a small herd is known to survive. A stray tiger or two occasionally kill in the same area, or in the hills south of Patkum, or on the Baghmundi range, and within the last few years several visitors from the Hazāribagh jungles have been shot near Jhalda. Leopards (felis pardus) are somewhat less rare in the same areas, and are also met with at times in the jungles which run up the banks of the Kāsai river through Parganas Mānbhum and Kāsaipar. They are also to be found, as also a very occasional tiger, on the Tundi range and on the foot hills of Parasnāth in the north. Other felines are represented by two or more varieties of wild cat, specimens of which though rarely seen are probably fairly numerous.

During the ten years ending 1908, 65 human beings and 2,181 cattle were reported to have been killed by tigers and leopards, and rewards were paid for the destruction of 3 tigers and 79 leopards.

The bear—the common black or sloth bear—is rather more common, and is still to be found in most of the wooded hills on the north, west and south of the district. On the Tundi and

Parasnāth hills on the north they must at one time have been very numerous as it is on record that one Sub-divisional Officer, who was at Gobindpur for several years in the eighties, shot over a hundred. During the ten years ending 1908, 11 human beings and 57 cattle were killed by bears and 45 bears were brought in for reward.

Wolves are said to be fairly numerous on and near the Pānchet hill, and are practically the sole relic of wild game in that neighbourhood; they are also met fairly frequently in other hilly and jungly parts of the district. Hyænas are to be found in the same regions and are apparently somewhat more numerous. Wolves and hyænas accounted during the last ten years for 16 human beings and 3,312 cattle and rewards were paid for the destruction of 45 wolves and 273 hyænas.

Jackals are, of course, numerous, but not nearly so common as might be expected from the general appearance of the country.

Of herbivorous quadrupeds the Sambar is almost extinct except on the Parasnāth and Dalma ranges where occasional specimens are seen; the spotted deer survives in certain more or less preserved jungles near Jhalda, Bāghmundi and Mānbazar, and a small herd is said to exist still in the jungles surrounding some low hills north-west of Balarampur. The barking deer is found occasionally in the same areas and in the Dalma range. The *chinkara* is practically unknown, and the four-horned antelope hardly survives except in the preserved jungles of the Pānchet zamindar near Kesargarh.

Wild pig are rarely to be found except in the dense jungles adjoining the Parasnāth and Dalma ranges; they do considerable damage to the crops grown on small patches of cleared land in and near the jungles, but in the struggle for survival they have little chance against the Sonthal or the Bhumij. The langur (*Semnopithecus entillus*) is to be found in the hills near Jhalda and elsewhere at various places but in no great numbers. One tribe or family visits Purūlia in the mango season and does some damage to the little fruit there is, until driven away.

The Indian fox is common throughout the district. The short-tailed Indian pangolin (*Manis crassicaudata*) an animal almost peculiar to this and the Singhbhum district of which a picturesque account is given in Hunter's Statistical Account of the district is not yet extinct though but rarely seen; a specimen was killed in Purūlia in 1907 while attempting to burrow its way into the local Post Office, and after seriously frightening the whole postal establishment. More recently another specimen was captured near Dhānbāid. Hares are very rare except where there are large areas of scrub jungle and broken ground, their habits making them a very easy prey for the aboriginal tribes, armed with bows, sticks or stones.

Game Birds.

The game birds of Mānbhum are few in number and variety; jungle, spur, and pea fowl can now but rarely be found and only in the wildest parts of the district; the grey partridge is fairly common in suitable country, the black is only very occasionally seen. Pigeon, both rock and green, are fairly common. Of cold weather visitors the snipe is the most numerous, and from November till May a wisp or two can usually be found in the rice fields immediately below most *bandhs*. Towards the end of the season when suitable grounds are less numerous and of smaller area it is possible to get a fair bag. Wild geese resort regularly to the beds of the larger rivers, the Dāmodar, Kasai and Subarnarekha, and a fair number of duck and teal are to be found on the larger *bandhs* throughout the district particularly in the later months of the season The most common varieties are the common or blue winged teal, the pintail, the white-eyed, common and red-crested pochards, the gadwal and the shoveller; whistling teal both great and lesser are found occasionally and a fair number of cotton teal stay through the year on some of the larger tanks, near which there is cover for their breeding. Mānbhum is mentioned by Mr. E C. Stuart Baker* among the habitat of the Nullah teal or comb-bill, but no specimen has been seen or shot of recent years. Golden plovers are seen occasionally in considerable flights on the high *taur* lands where also the common plover is fairly common. Of other birds the most common are the crow, the *maina*, the sparrow and the paddy-bird.

Fish.

Many of the tanks and irrigation bandhs are regularly stocked with fry of the *rui*, *mirgel* and *katla* species, and various small species are to be found in almost every piece of water. *Hilsa* and *bachwa* are caught in the Dāmodar and Subarnarekha during the rains and both these rivers are said to contain mahseer.

Reptiles.

Snakes are not specially numerous; of the poisonous varieties the cobra and the karait are fairly common; of others the most frequently seen is the *dhaman* which grows to a considerable size. In the hilly areas an occasional python is met with; and various harmless and grass snakes are generally common. During the ten years ending in 1908, 1,022 persons were reported to have been killed by snakes, and 3,859 snakes were destroyed.

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* The Indian Ducks and their Allies. Bombay, 1908.

Climate.

The climate is generally much drier than that of Eastern Bengal, though less so than that of the plateau of Chota Nāgpur proper. From early in March till the end of May or the beginning of June hot westerly winds ordinarily prevail, and the heat during the day is oppressive, the thermometer in the shade constantly rising as high as 110° and not infrequently several degrees higher. Towards evening the west wind usually drops, or dies away altogether, and there is a considerable fall in temperature. The nights during March are still cold, during April usually bearable, but towards the end of May the minimum night temperature is frequently above 90°. Occasional relief is afforded during these months by nor'-westers, which, even when not accompanied by rain, reduce the temperature by several degrees, and relieve the general feeling of oppression With June the wind veers to the south or east, the actual temperature drops, but the air becomes saturated with moisture, and, until the rain actually comes, the climate is unpleasant in the extreme.

During the rains which normally set in about the middle of June, and last till the middle of September, the climate is on the whole pleasant; the country being naturally well-drained, and the soil mainly composed of sand and gravel, the air is comparatively dry in the intervals between the rain, and the sultry, damp and steamy atmosphere of a Bengal district at the same season of the year is comparatively uncommon.

The end of September with a hot midday sun and the air still moist is fairly trying, but with October cooler currents of air from the north and west set in, and by the end of the month the cold weather is ordinarily well established.

From November to mid February the days are not unpleasantly warm, and the nights cool; the air is ordinarily dry and bracing, and a healthier or more enjoyable climate could hardly be wished for. Extreme cold is rare, and frost except on the higher hills practically unknown.

The range of temperature during the year is considerable. The mean maximum temperature, which is between 76° and 79° during December and February, rises to 89° in March, and in April and May to 103°. Throughout the rains it averages about 90° dropping to 88° in October and 84° in November.

The mean minimum temperature varies from as low as 52° in January to 79° in June, the mean for the cold weather months being about 58° and for the hot weather 76°. The mean temperature for the year is 77°.

RAINFALL.

The average monthly rainfall from seven reporting stations (Purūlia, Gobindpur, Raghunāthpur, Barabhum, Jhalda, Chās and Pāndra) is shown in the annexed statement. Besides these there are registering stations more recently established at Manbazar, Bandwan, Kailāpal, and Dhānbāid. Between the different stations the differences are not very marked, the total rainfall of the year varying only between 49¾ and 55½ inches.

Statement showing the average rainfall month by month for each reporting station.

Serial No.	Name of rain reporting stations.	AVERAGE RAINFALL MONTH BY MONTH.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1	Purūlia ...	0·44	1·02	0·98	0·99	2·94	10·09	12·23	12·26	8·14	3·24	0·24	0·18	52·77
2	Gobindpur .	0·59	0·89	0· 7	0·69	2·60	9·34	14·12	13·40	8·92	3·40	0·22	0·16	55·19
3	Raghunathpur	1·47	0·54	0·74	0·75	3·60	7·47	13·25	12·73	7·95	1·72	0·17	0·08	49·77
4	Barabhum ...	0·25	0·65	0·94	1·32	2·61	10·94	12·82	11·73	9·36	2·3	0·53	0·13	53·67
5	Jhalda ..	0·49	0·80	1·23	1·30	2·53	10·21	12·56	15·00	7· 6	2·71	0·27	0·14	55·20
6	Chās .	0·63	0·48	0·74	1·07	2·74	8·06	12·13	12·46	8·34	2·43	0·32	0·14	49·54
7	Pāndra ..	0·41	0·78	0·33	1·00	3·25	11·00	12·51	11·86	8·94	2·09	0·14	0·04	52·33
		0·46	0·73	0·81	1·01	2·89	9·78	12·80	12·78	8·51	2·58	0·31	0·12	52·35

As might be anticipated, the rainfall is heaviest near the hilly areas in the north, west and south, and lightest in the comparatively level central area. In respect of variation from year to year the range is considerable; just under 100 inches were recorded at Gobindpur in 1893, in which year the average for the district was 73½ inches; two years later, in 1895, the average fall was only 34½ inches, and in 1896 barely 37 inches.

The cold and hot weather rains are usually very light, less than 3½ inches being ordinarily precipitated in the six months, November to April. The fall in May averages just under 3 inches, and the burst of the monsoon in June gives some 9¾ inches; July and August with nearly 13 inches each are the wettest months; in September the fall averages about 8½ inches, and the final effort of the monsoon gives another 2½ inches in October. It is this final rain which in an otherwise normal year makes the difference between a full and an average, or even a comparatively poor crop.

APPENDIX TO CHAPTER I.

GEOLOGY.

E. W. VREDENBURG.

General Features.

Geological constitution of the district.

FROM the point of view of the geologist Mānbhum can be divided from north to south into three successive belts, each of which stretches across the entire width of the district in an east and west direction. The northern belt is occupied mainly by the two great coal-basins of Rāniganj and Jharia, separated by an intervening area of crystalline rocks. The middle belt, which is broadest, is occupied almost exclusively by crystalline rocks The southern belt includes a series of ancient slates with associated volcanic rocks belonging to the group of rocks known to Indian geologists as the Dhārwār System.

Consequently the district includes a very great variety of different rocks, and it is a patchwork of formations which differ widely in age, in structure, and in history. The crystalline gneisses and the sedimentary Dhārwārs belong to the oldest formations known in India. They have been extensively disturbed and altered since their original formation. The rocks of the coal-basins in the northern belt of the district are less ancient and belong partly to the end of the period known to geologists as the "primary" or "palæozoic", partly to the beginning of the succeeding period known as "secondary" or "mesozoic". They constitute a portion of the group of rocks classified by Indian geologists as the "Gondwāna System" which consists of fluviatile sandstones and shales with intercalated coal-seams. These rocks have not been subjected to disturbances and alteration to the same extent as the older gneisses and Dhārwārs, and being usually far less indurated than those older formations, would have been mostly denuded away were it not that they have been let in amongst the older rocks along a series of faulted fractures, some of which indicate an enormous amount of subsidence.

Faulted fractures.

The faulted fractures which affect the Gondwāna rocks of the coalfields are the latest disturbances of this kind which one observes in the district. Evidence of older faulted fractures abound in the gneissose and Dhārwār areas.

Absence of well-marked topographical features.

The extreme variety and checkered geological history of the rocks of this district are only very feebly expressed by its topographical features. Most of the structural features of the rocks exhibit an east and west trend; but this structure has very little influence upon the direction of the lines of drainage, most of which flow obliquely to the strike of the rocks, and are scarcely deflected to any appreciable extent when they pass from one formation to another. Some of the 'great structural faults are of enormous "throw", for instance, that forming the southern border of the Rāniganj coalfield which represents a subsidence of the Gondwāna strata of nearly two miles. Yet these great fractures are without any effect on the topography.

The only rivers whose course has been materially influenced by the nature and structure of the rocks are the Dāmodar, and to a minor extent some of its tributaries where they traverse the Gondwāna basins, as will be explained when dealing with the structure of the coal-fields.

Long-continued sub-aerial denudation.

It is the protracted denudation to which the region has been subject that accounts for the want of correspondence generally observed between its structural features and the directions of drainage. The district has been a dry land area subjected to atmospheric weathering and denudation since a very early geological period, and it has not been subjected to any earth-crust movements capable of influencing appreciably the shape of its surface since the completion of the great faulted fractures that limit the Gondwāna areas. These date back to a time previous to the close of the secondary era, and most parts of the earth's surface that have been dry land from so early a geological time have had the irregularities of their topography similarly reduced: the great mountain ranges, such as the Alps and Himalayas, owe their strong relief to the fact that they were uplifted only at a late period of the Tertiary era. In the case of a region subjected to denudation since a very early date, like that of Mānbhum, the levelling action of denudation has been so protracted that, with the exception of a general seaward slope towards the Bay of Bengal, the only differences of level observed are due to relative differences in hardness of the rocks, without any reference to former movements of upheaval or subsidence. The extent to which the present topographical features are disconnected from the former geological history of the region is well illustrated in the case of Pānchet hill, and a few other hills along the southern border of the Rāniganj coalfields. They owe their present relief to the fact they consist of hard sandstones and conglomerates that have resisted denudation better than the softer surrounding rocks; yet they occur on the downthrow side of one of the greatest faulted fractures of the district, and have sunk to a depth of almost two miles relatively to the older crystalline rocks which they overlook on their southern aspect. Ages of denudation have so equalised the level of the surface on the downthrow and upthrow sides of the fault that it is the sunken portion that now exhibits the strongest relief.

Topography depending solely on differences of hardness of rocks

The other outstanding hills of the district all owe their preservation similarly to the relative hardness of the rocks constituting them; such are Dalma hill, at the southern border of the district, consisting of a great mass of "epidiorite"; Parasnāth hill, whose lower spurs touch the north-western edge of the district, consisting of a compact augite-enstatite granulite similar to the pyroxene granulites of the "Nilgiri gneiss" that constitute the loftiest hills in Southern India: the Bāghmundi plateau in the south-western part of the district, consisting of compact granite or granitite gneiss.

Structure of Gondwāna basins.

The geological formation that has attracted more attention than any other owing to its economic importance is the coal-bearing Gondwāna formation which occupies the Rāniganj and Jharia coalfields in the northern belt of the district. The Gondwāna rocks consist essentially of a succession of fluviatile sandstones and shales with intercalated coal-seams, which exhibit a general southerly dip, in such a manner that the oldest beds outcrop at the northern edge of the coal-basins, and the newest beds at its southern edge, where the succession is abruptly interrupted by the great structural fault that constitutes the main southern boundary of each of the coalfields. With few exceptions the Gondwāna rocks are moderately indurated and easily denuded away, and, owing to this relatively easy weathering, the larger channels of drainage have established themselves on their surface more easily than on the adjoining rocks. This is why the course of the largest river of the region, the Dāmodar, coincides

Influence of Gondwāna rocks on drainage.

with the position of the coal-basins. Moreover, the general southerly dip of the coal-bearing strata has had the effect of constantly displacing the main channel towards the south, so that the Damodar generally follows at a short distance the main southern faulted boundary of the coal-fields. Similar features are observed in all the coal-basins of India, which always exhibit the same unsymmetrical structure as the Rāniganj and Jharia basins, and almost invariably have their main boundary fault approximately coinciding with a great channel of drainage: a conspicuous instance is that of the Gondwāna basin of the lower Godāvari.

Intrusive rocks.

In addition to the three great systems of rocks that make up the Mānbhum district, that is, the Gondwāna, the crystalline gneisses and the Dhārwar slates, there are numerous igneous intrusions varying in composition from acid (highly siliceous) to basic (comparatively poor in silica, but rich in lime, iron, and magnesia). The basic intrusions being more easily recognised have more particularly attracted attention, and generally have the shape of elongated linear vertical "dykes" representing fissures that have been filled up from below with a molten material of volcanic origin. Some of these basic intrusions are of very ancient date, almost or quite as old as the Dhārwār slates, and are probably contemporaneous with the ancient "basic" rocks of Dalma hill They are observed principally in the gneiss areas, and having shared in the disturbance that has affected the gneiss and the Dharwār slates, they have been affected by alterations which considerably disguise the original character of their minerals. The later set of basic dykes is contemporaneous with the volcanic eruptions of the Rājmahal hills in Bengal. They are posterior to the latest dislocations that have affected the region, and except where acted upon by atmospheric weathering close to the surface, are quite unaltered. They are observed cutting through the Gondwāna rocks and also through the surrounding crystalline rocks, but are much more abundant within the Gondwāna areas than through the surrounding country because the soft Gondwāna sandstones and shales have afforded an easier path to the injected material than the harder surrounding crystalline rocks

Structural directions.

The main structural features of the district as expressed by the strike of the rocks are directed from east to west, with some subsidiary deflections to north-west and south-east. The same directions are reflected in the faulted fractures so frequent throughout the district: the main directions of faulting are also east-west and north-west to south-east. Both directions are conspicuously exhibited in the main faults of the Rāniganj coalfields. Both inside and outside the coalfields, the north-west to south-east direction is that most frequently followed by the great intrusive dolerite dykes of Rājmahal age.

Fault-rock.

One of the most noteworthy rocks of Mānbhum, not from its bulk but for its wide distribution, is a peculiar siliceous and sometimes ferruginous rock which accompanies lines of faulting.

The Gondwāna Coalfields.

Though occupying less superficial extent than the gneiss and Dhārwār formations, the Gondwāna is the most important of the geological formations represented in Mānbhum on account of the immense value of its associated coal seams. Indian geologists have divided the Gondwāna system into a lower, a middle, and an upper series, of which the two first-named are exhibited in the Mānbhum coalfields.

The Gondwāna rocks occurring in Mānbhum include the following subdivisions:—

- Middle Gondwāna
  - Kāmthi.
  - Pānchet.
- Lower Gondwāna
  - Dāmodar
    - Rāniganj.
    - Ironstone shales
    - Barākhar.
  - Tālcher.

Tālcher stage.

The Tālcher subdivision is of moderate and rather uniform thickness, about 500 to 800 feet. It consists of fine-grained arenaceous shales of greenish grey, more rarely of red colour, and fine-grained soft sandstones, greenish-grey or reddish, consisting of quartz and undecomposed felspar. The shales are greatly jointed and break up into angular, often pencil-shaped, fragments. They are frequently calcareous. The sandstones are somewhat thickly, though distinctly, bedded, occasionally interstratified with shales, and often break up into cubic pieces for which reason they have received the name of "tesselated sandstones." The sandstones usually predominate in the upper portion of the Tālchers, there being a gradual increase in the coarseness of the sediments as one ascends through the section. Pebbles of various dimensions, sometimes reaching the size of large boulders, are frequently

Boulder-beds.

scattered through the fine shales or mudstones towards the base of the series, and constitute the Tālcher "boulder-beds." The pebbles often consist of rocks that do not occur in the neighbourhood of the Tâlcher exposures in which they are found, and which must have been carried from a distance by glaciers. Similar indications of extensive glaciation have been detected in many other parts of the world amongst rocks of the same geological age as the Tâlchers, that is, belonging to the passage zone between "Carboniferous" and "Permian." At that period the world must have passed through an ice-age somewhat similar to the one which immediately preceded the present era.

Permian ice-age.

Tâlcher fossils.

The Tâlcher beds are usually barren of coal seams. The lower strata of the Tâlcher shales are unfossiliferous, as though, at the time they were deposited, the climate were still too severe for a luxurious development of vegetable life. The upper strata of the Tâlcher are sometimes fossiliferous and contain a flora which is markedly different from that of the overlying Dāmodar, the leading forms being various species of a fossil fern known as *Gangamopteris*.

Dāmodar stage.

In the Rânigan j and Jharia coalfields, the Tâlcher is succeeded with varying degrees of overlap and unconformity by the coal-measures of the Dāmodar division. The Dāmodar stage is most completely represented in the Rânigan j coalfield which may be taken as the type for this division, the differences in other areas consisting principally in the absence or less complete development of the newer sub-stages.

The three sub-stages exhibited in the Rânigan j field are in ascending order, the Barākhar, ironstone shales, and Rânigan j.

Barākhar sub-stage.

The Barākhars, with a thickness of about 2,000 feet, consist of coarse conglomerates with white or buff sandstones and numerous coal-seams, the lowermost of which are often very thick. The pebble beds are particularly frequent towards the base of the sub-stage, the sediments becoming gradually finer in an upward direction. The Barâkhar sandstones are sometimes felspathic, but the felspar grains are kaolinised, instead of being undecomposed, as in the case of the Tâlchers.

Ironstone shales.

The ironstone shales, about 1,400 feet thick, are black carbonaceous shales, with numerous bands of clay ironstone, the ferruginous element occurring in the form of iron carbonate. They sometimes constitute valuable iron-ores. The average amount of metallic iron in the clay-ironstones is 39 per cent Some of the richer bands in the Rāniganj coalfield contain as much as 54 per cent.

Rāniganj sub-stage.

. The Rāniganj sub-stage, with a maximum thickness of 5,000 feet, which it attains only in the Rāniganj coalfield, consists of sandstones, both coarse and fine-grained, mostly felspathic and false-bedded, intercalated with a large proportion of shales, together with coal-seams. The coal seams are thinner, but more constant than in the Bārakhar.

Dāmodar fossils.

Fossil plants occur abundantly in some of the Dāmodar strata. The leading fossils belong to the genera *Glossopteris*, *Schizoneura*, *Phyllotheca* and *Sphenophyllum*, the first of which is allied to the ferns, the other three to the *Equisetaceæ*.

Pānchet stage.

All three subdivisions of the Damodar, together with the underlying Tālcher, are exposed both in the Rāniganj and Jharia coalfields. The overlying Pānchet beds are absent from the Jharia coalfield, but are well exposed in the Rāniganj coalfield where they occupy a considerable area in the southern part of the coal-basin, and constitute the underscarp of Panchet hill, the upper crags of which consist of Kāmthi sandstone. In the Rāniganj field they attain a total thickness of about 1,500 feet consisting principally of very false-bedded coarse sandstones and red clays, with the exception of the lowest 250 or 300 feet which consist of grey and greenish-grey sandstones and shales, often micaceous and very thin-bedded, and not unlike some of the Tālcher beds.

Vertebrate fossils.

The Pānchet beds are barren of coal-seams. Sometimes they contain poorly preserved impressions of fossil plants, which, when recognisable, appear to be closely related to or identical with common Dāmodar forms. They have also yielded remnants of labyrinthodont amphibians belonging to the genera *Gonioglyptus*, *Clypotognathus* and *Pachygonia* and primitive reptiles of the genera *Dycinodon* and *Epicampodon*

Intrusive rocks in Gondwāna coal-fields.

Both in the Rāniganj and Jharia coalfields the Gondwāna strata are penetrated by numerous igneous intrusions, principally in the form of dykes, which usually stop short at the faulted boundaries of the coal-basins, although they occasionally extend beyond them. They are mostly or entirely of later age than the faults. Their preponderance within the Gondwana areas probably stands in relation to the fractured condition of the earth's crust in these sunken areas, and also with the greater ease with which the relatively soft sediments of the Gondwānas could be rent asunder by intrusive masses as compared with the much more compact surrounding gneisses and schists.

These intrusions are connected with the Rājmahal period of volcanic activity, probably of liassic age. They belong to two distinct types:—

(1) A group of mica-peridotites remarkable for the amount of apatite they contain.
(2) Large dykes of ordinary basalt or dolerite.

Both sets of intrusions belong to one geological epoch, though the mica-peridotites are more frequently observed crossing the dolerite ones than the reverse.

Mica-peridotite.

The dykes of mica-peridotite are generally narrow, not exceeding 3 to 5 feet, and at the surface are always decomposed to a soft buff-coloured crumbling earth, which is often vesicular and contains remnants of partially decomposed bundles of mica. The vesicular appearance is caused by the removal of some of the minerals by superficial weathering. Traced below the surface in the colliery workings, the rocks where unaffected by surface alteration, have a very different aspect, appearing as compact, tough and almost black rocks with spangles of biotite, glassy-looking porphyritic crystals of olivine, and large numbers of acicular crystals of apatite. They are seen to send out ramifications into the surrounding coal and sandstones and in some places they thicken out into boss-like masses or even spread out in wide sheets along the bedding planes, coking the coal with the production of remarkable columnar structures, baking the shales, and partially fusing the felspathic sandstones into compact rocks.

Fresh specimens of these mica-peridotites have a specific gravity of nearly 3. The primary minerals of the unaltered rocks, arranged in their order of crystallisation, are apatite, olivine, magnetite with varying amounts of chromite and ilmenite, biotite, a brown hornblende which has been regarded as anthophyllite, augite. The secondary minerals developed by the contact with the coal-seams are serpentine, secondary magnetite, a titaniferous mineral which has been regarded as perofskite, rhombohedral carbonates, chiefly dolomite, pyrites.

A constant character of these remarkable rocks is the exceptional quantity of apatite (phosphate of lime) which they contain, amounting in some of the freshest specimens from underground workings to as much as 11·5 per cent. of the rock.

Exceptional richness in phosphorus.

The basalt and dolerite dykes are easily distinguished from the associated intrusions of mica-peridotite, by their physical and mineralogical characters and their frequently much greater dimensions. They display a more or less columnar or polyhedral jointing, and the spheroidal jointing that usually characterise such rocks. They sometimes attain a thickness of 100 feet, and yet the action on the adjacent strata is in no way comparable to the effects of the much narrower intrusions of mica-peridotite. They do not penetrate the coal-seams like the mica-peridotites, and have never been observed to spread out into sills parallel with the stratification.

Dolerite dykes.

The specific gravity of these rocks averages 2·99. They consist chiefly of olivine, plagioclase felspar, and augite.

The Gondwana coal has a very pronounced laminated appearance, owing to its being invariably composed of layers of varying thickness, which consist alternately of a bright jet like black substance, and of a dull lustreless material. The brighter portions consist of very pure coal, while the dull portions are nothing more than an extremely carbonaceous shale. Hence the value of any Gondwāna coal depends mainly on the proportion of bright laminæ. In many instances the carbonaceous coal constituting the dull layers is too impure to soften by heat and constitutes an impediment to the manufacture of coke. Nevertheless excellent coke is obtained from many Gondwāna coals.

The Gondwāna coal.

The disturbed condition of the earth's crust along the main lines of faulting of the great coalfields, is revealed by the presence of mineral springs. Those situated near the Dāmodar river have especially attracted attention, such as the one situated below Chānch, on the faulted boundary of the Rāniganj coalfield. Two miles south-west of the Chānch spring is that of Tentulia on the south bank of the Dāmodar river, which is sulphurous and is said to have a temperature of 190° F. (88° C.). There is another hot spring on the north bank of the Dāmodar, situated 5 miles east by north of the

Hot springs along faulted boundaries.

eastern termination of the Jharia coalfield along the eastern continuation of the main boundary fault of that coal-basin.

A hot or tepid spring is said to flow at the south-west corner of Susunia hill where the quarries of "Burdwan stone" are situated.

The Dhārwār system.

The next older group of rocks anterior to the Gondwānas is the Dhārwār system which is indeed considerably more ancient, since it includes the oldest undoubted sediments met with in India.

Northern boundary of main outcrop of Dharwars.

The main outcrop of the Dhārwārs forms the southernmost belt of Mānbhum district. The northern boundary of this outcrop is described as a fault. The most eastern point where it has been observed is along the borders of the alluvium near Bhelaidiha in Bānkura district, and from there it has been followed westwards to a point beyond Bandgaon in Rānchi district, for a total distance of more than 100 miles. The faulted boundary runs just north of the towns of Ambikānagar and Barābhum, and crosses the Subarnarekha river six miles north-west of its confluence with its important tributary, the Karkari. The town of Barābhum, though situated south of the northern boundary of the Dhārwār belt, is not built on Dhārwār rocks, but on an inlier of granitic gneiss.

Constitution of Dhārwārs.

The Dhārwārs consist of quartzites, quartzitic sandstones, slates of various kinds, shales, hornblendic, mica, talcose and chloritic schists, the latter passing into potstones, and interstratified greenstones or diorites with what appear to be interstratified volcanic ash beds.

Calcareous jasper.

A particularly noteworthy rock amongst the Dhārwārs is a distinctly bedded siliceous rock having the appearance of black chert or Lydian stone or jasper. Its surface, under the influence of weathering, assumes a white crust, due to the removal of a small quantity of carbonate of lime. The colour is an intense black and the fracture conchoidal. These jaspidous rocks sometimes graduating into limestone are frequently observed amongst the ancient sediments of India.

Potstone.

Throughout the area of the Dhārwār rocks, magnesian schists are of common occurrence; they vary considerably in texture and composition. There are talcose and chloritic schists, soapstones, and potstones; many of the varieties are quarried and manufactured by means of rude lathes into plates, curry-dishes basins, and Mahadeos. One variety is not much esteemed owing to its inability to sustain heat. This is probably due to the presence *of chlorite which contains a larger percentage of water* of combination than the talcose minerals. The cracking of this variety is, therefore, doubtless caused by the liberation of this water when heat is applied.

Sequence amongst Dhārwārs.

So far as any regular sequence can be made out amongst the Dhārwār beds, it would seem as though the lowest strata consist of chloritic schists and potstones accompanied by hornblendic rocks and quartzites. A somewhat higher zone appears to consist of slates, schists, and of particular earthy shales closely resembling those of the Tālcher series, and, like them, perhaps indicating the former existence of glacial conditions at a still more remote period of the earth's history.

Fault-rocks along boundary of Dharwars.

Along the faulted northern boundary, the line of fracture has become, by means of infiltration, the receptacle of various mineral substances, principally silica and ores of iron In many places the iron ore first deposited has subsequently been replaced by fine-grained quartz, some of the pseudomorphic plates of which show the delicate etching which occurs on "specular iron", while in other cases the iron has not been completely removed, but is retained in the interstices. Sometimes the quartz occurs massive but penetrated by numerous intersecting veins. The line of fracture is particularly evident to the north and north-east of Ambikanagar, near the eastern border of the district, where it is marked by deposits of hæmatite which appear to contain a great abundance of rich ore. In the hills between Balarāmpur and Bauch, nine miles west by north of Ambikānagar, there is, along the same line of fracture, another strong deposit of hæmatite, beyond which, and on the same disturbed line, there is an old worked-out copper mine in which traces of malachite and azurite are still to be found as encrustations on the neighbouring rocks. In its vicinity there is a vein of coarse crystalline dolomitic limestone. Further west, again, the fault is marked for a distance of 10 miles towards Barābhum by a range of hills 250 to 300 feet high, and striking 25° north of west, which consist of pseudomorphic quartz. Exposures of fault rock are also observed at a distance of 18 miles west of Barābhum. West of the Subarnarekha river, the western continuation of the fault has been traced into Ranchi district.

Physical features of Dhārwār outcrop.

The Dhārwārs constitute a region of jungle-clad hills, the lines of height generally following an east-west trend concording with the strike of the stratification. It is the harder bands amongst the strata which are particularly adapted to stand out as hills, and the succession of hill-formers is best seen in the neighbourhood of the Subarnarekha river; the northernmost range consists of a cherty quartzite which rises into saddle-shaped hummocks, then follow two chains of truncated or perfectly conical hills formed of slate, then a massive range of irregular elevation composed of basic volcanic or intrusive rock whose highest part forms the fine hill of Dalma. South of the igneous range are two more ranges, one of felspathic quartzite, and the other of talcose and micaceous schists of tolerably equable elevations throughout.

The Dalma Trap.

The Dalma trap forms, as it were, the backbone of the hilly region in southern Mānbhum and separates this district from that of Singhbhum situated next to the south.

The exact relation of the Dalma trap to the associated rocks is not quite clear owing to their disturbed condition and to the amount of alteration which they have suffered. The rock constituting the "Dalma Trap" is not a continuous compact intrusion, for it is interleaved with some of the typical representatives of the Dhārwārs, such as indurated chloritic schists. Perhaps it may include both interbedded and intruded elements. The occurrence of southerly dips amongst the beds north of the band of volcanics, and of northerly dips amongst those south of it, might lead one to infer a synclinal structure, but this is not confirmed by any repetition of the beds on either side of the supposed synclinal axis. Moreover, the occurrence of masses of hæmatite on the north side of the volcanic rocks, similar to those observed along the northern faulted boundary of the Dhārwārs, suggests the existence of local faults indicating that the structure is complex.

Lithologically the "Dalma Trap" is sometimes compact, sometimes vesicular and amygdaloidal. At other times it exhibits a brecciated structure. It belongs to the class of rocks which petrologists classify under the name of "epidiorite," that is, a basic igneous rock which has undergone alteration through earth-movements subsequent to its consolidation, the main result of the alteration being the transformation of the mineral "augite" into the mineral "hornblende."

The Dalma Trap appears to represent one particular horizon corresponding with a period of exceptionally pronounced volcanic activity. It is not, however, the only volcanic rock associated with the Dhārwārs; all through the Dhārwār outcrop there are hornblendic rocks and presumed ash-beds which seem to be of volcanic origin.

At Bāngurda, six miles south-east by south of Barābhum, there is a basic igneous rock which forms a range of bare red hills. The colour is due to the weathering out and decomposition of magnetic iron, and the detritus from it is almost identical with one of the commonest varieties of laterite.

Degree of metamorphism of Dharwars.

The Dhārwār strata of Mānbhum, in spite of their great geological antiquity, are often but very slightly altered, much less so than in most other outcrops of these rocks in other parts of India; slaty cleavage is sometimes so feebly developed that the argillaceous varieties of the strata are merely in the condition of shales. It often happens, however, that the rocks are considerably metamorphosed, just as much as in other parts of India, and have become slaty, or even crystalline.

In places where the degree of metamorphism is not greatly pronounced, the finer sediments do not assume the form of slates, but merely consist of ordinary shales, some of the green-coloured varieties of which might be easily mistaken for Tālcher shales were it not for the quartz-veins which traverse them and which are not observed amongst the Gondwāna sediments

Auriferous veins.

The metamorphism is perhaps less pronounced in the eastern and southern portions of the Dhārwār band than in its northern and western parts; it is, however, very irregularly distributed. The quartz-veins, which cut through the Dhārwār sediments in all situations, are frequently auriferous.

Granitic intrusions are absent from the great spread of Dhārwār rocks which occupies the southernmost part of the district. Yet the intrusive granites observed in the middle belt of the district may be partly of later age than the Dhārwārs; only as the rocks with which they come into contact are either pre-Dhārwār gneisses, or else schists which may be of Dhārwār age but are metamorphosed beyond recognition, it is impossible, at present, to obtain undoubted evidence in this respect.

Dhārwār outliers near Mānbazar.

Close to the eastern edge of Mānbhum district there are some outliers of Dhārwārs surrounded by gneiss, but situated quite close to the main outcrop. They are observed principally in the neighbourhood of Mānbazar. They are affected by well-marked faults, the edges of the different formations being in some places in abrupt contact and in others only separated by ridges of pseudomorphic quartz or lodes of brown hæmatite. The rocks occurring in these detached areas are chiefly alternations of quartzites, potstones, and hornblendic rocks corresponding to the lowest zone of the Dhârwârs of this area.

Susunia hill.

In the middle belt of Mânbhum, the Dhârwârs are interfoliated to such an extent with older gneisses and perhaps with younger granites that it becomes difficult to separate them, and no accurate mapping of this area has yet been attempted. The most remarkable outlier of the Dhârwârs in this middle belt is that constituting Susunia hill, and which yields the so-called Burdwan paving stone. Susunia hill is about 15 miles south-south-west of Rāniganj; it rises abruptly to a height of 1,443 feet. It is chiefly formed of quartzites and felspathic quartzites, with occasional traces of mica. The beds dip generally 10° east of north at angles of 20° to 25°, but owing to some rolls and contortions, the azimuth varies to east, north-east, and north-west. The beds are traversed by three systems of joint planes which facilitate the quarrying of the stone to a very material extent.

Altered rocks perhaps referable to the Dharwars.

Other outcrops, probably also representing altered Dhârwârs, are observed up to the northernmost limit of the district. For instance, at Pândua Hât, a locality situated 13 miles west of Barākhar, midway between the Rāniganj and Jharia coalfields, there are mica schists succeeded to the north by thick and thin even-bedded grey, pale drab and brown quartzo-felspathic rocks with a dip of 10° to 15° to the north, which show but small signs of metamorphism, and probably represent a local outcrop of Dhârwâr rocks.

Another series of rocks which possibly may represent metamorphosed Dhârwârs, are a succession of schists which are situated south of the eastern portion of the Jharia coalfield, and which are particularly clearly exposed in the Tasarkua river and in the Gowai river below its confluence with the Tasarkua. They include mica-schists and chloritic schists passing into potstones, some of which have been quarried for plate-making, but being generally distinctly schistose, and therefore too fissile, are much less suitable for the purpose than are the compact varieties which are common in the unaltered or slightly altered areas of the Dhârwârs. The mica schists of the Tasarkua and Gowai exposures frequently contain crystals of garnet, tourmaline and kyanite. All these rocks are profusely injected with veins of granite and pegmatite which no doubt account for their condition of metamorphism.

Alluvial gold.

Alluvial gold washings occur at a number of localities throughout the Dhârwār area. The gold in the alluvium originates from the disintegration of the numerous auriferous quartz veins which intersect the Dhārwār slates, but do not contain the precious metal in sufficient proportion to repay the cost of mining.

The largest grains of alluvial gold so far recorded were obtained from the Gurum river never Dhadka, and were accompanied by minute flakes of platinum.

Magnetic sands.

The same streams which contain alluvial gold that has accumulated in the sand owing to its heavy specific gravity, also contain accumulations of magnetic iron sand, whose accumulation is due to the same mechanical causes. The magnetite is derived from the disintegration of certain chlorite schists crowded with magnetite crystals which abound in certain parts of the Dhârwâr outcrop.

Archæan Gneisses.

Distribution of Archæan gneisses.

The northern belt of Mānbhum is not occupied exclusively by the Gondwâna rocks described in connection with the coalfields but also includes various ancient gneisses and schists occupying the interval between the Rāniganj and Jharia coalfields. They have received very little attention as compared with the rocks of the coal-basins, and, in all their characters they agree essentially with the crystalline rocks occupying so extensive an area throughout the middle belt of Mānbhum.

The Bengal gneiss.

The rocks in the middle belt of Mânbhum consist partly of an older set of foliated gneisses and schists and partly of a newer set of intrusive granites. The older set which constitutes the geological group, known as the "Bengal Gneiss," includes mica-schists, chloritic schists, quartzites, felspathic quartzites, hornblende schists, biotite and hornblende granitic gneisses some of which are porphyritic. A great many of these rocks are older than the Dhârwârs; but amongst them are probably included foliated members of the Dhârwâr series whose characters have become disguised by regional metamorphism. The granitic intrusions are probably newer than the Dhârwârs.

Except for local disturbances, the general trend of the gneiss throughout the middle belt of Mānbhum is east-west.